

OBSERVATIONS ON THE GREAT LAKES.

REPORTS FROM U. S. LIFE-SAVING STATIONS.

Through the co-operation of the General Superintendent of the Life-Saving Service and the Secretary of the Treasury, the Weather Bureau has received monthly reports for the

month of September from the keepers of 40 U. S. Life-Saving Stations on the Great Lakes.

REPORTS FROM VESSELS.

The Lake Marine Section of the Forecast Division has received 68 reports from vessels navigating the Great Lakes.

SUNSHINE AND CLOUDINESS.

GENERAL REMARKS.

The quantity of sunshine, and therefore of heat, received by the atmosphere is a fundamental factor in meteorology; the quantity received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends largely upon the absorption by the atmosphere and varies with the distribution of cloudiness. The sunshine is now recorded automatically at about 39 regular stations of the Weather Bureau, either by its photographic or its thermal effects. The cloudiness is recorded by personal observations at all stations and is given in the column of "average cloudiness" in Table I.

SUNSHINE.

An instrumental record of sunshine has been kept during the month at 18 stations by means of the photographic sunshine recorder and at 21 stations by means of the thermometric sunshine recorder; the results of these observations are given in Table IV, for each hour of local mean time (not seventy-fifth meridian time). The stations recording the largest percentages of sunshine between the hours of 11 a. m. and 1 p. m. were: Tucson and San Francisco, 94; New Orleans and Vicksburg, 92.5; Detroit, 92; St. Louis, 89. The stations having the least percentage between these hours were: Portland, Oreg., 49; Savannah, 51; Spokane, 55; Rochester, 57.5; Eastport, 58; Baltimore, 60; Wilmington, 61; Bismarck, 66.5.

The general average percentage for the whole month is given in the next to the last column of Table IV. The highest percentages were: Tucson, 89; Santa Fe, 82; New Orleans and Salt Lake City, 80. The lowest percentages were: Eastport, Portland, Oreg., and Rochester, 44; Wilmington, 47; Savannah, 53.

CLEAR SKY.

The average cloudiness between sunrise and sunset, as based on numerous personal observations, is given for each Weather Bureau station in Table I; the complement of this average

cloudiness gives the observer's estimated percentage of clear sky and these latter numbers are given in the last column of Table IV.

COMPARISON OF SUNSHINE AND CLEAR SKY.

The sunshine registers give the duration of direct sunshine whence the percentage of possible sunshine is derived; the observer's personal estimates give the percentage of area of clear sky. It should not be assumed that these numbers should agree, and for comparative purposes they have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental record of percentages of duration of sunshine is almost always larger than the observer's personal estimates of percentages of area of clear sky; the average excess for this month is 8 per cent for photographic records and 11 per cent for thermometric records:

Difference between instrumental and personal observations of sunshine.

Photographic stations.	Instrumental.	Personal.	Difference.		Thermometric stations.	Instrumental.	Personal.	Difference.
Tucson, Ariz.	89	75	14		New Orleans, La.	80	79	1
Santa Fe, N. Mex.	82	77	5		Salt Lake City, Utah	80	70	10
San Francisco, Cal.	77	79	-2		Colorado Springs, Colo.	78	69	9
Denver, Colo.	76	63	13		St. Louis, Mo.	76	65	11
Dodge City, Kans.	76	68	8		Vicksburg, Miss.	76	74	2
Cincinnati, Ohio.	74	58	16		Detroit, Mich.	75	62	13
Kansas City, Mo.	70	56	14		Key West, Fla.	73	42	31
Cleveland, Ohio.	66	57	9		Chicago, Ill.	70	60	10
Galveston, Tex.	64	64	0		Columbus, Ohio.	70	60	10
Memphis, Tenn.	64	64	0		Louisville, Ky.	64	46	18
San Diego, Cal.	64	54	10		Little Rock, Ark.	63	49	14
Bismarck, N. Dak.	63	63	0		Buffalo, N. Y.	60	41	19
Helena, Mont.	62	51	11		Philadelphia, Pa.	60	41	19
Washington, D. C.	59	53	6		New York, N. Y.	59	45	14
Spokane, Wash.	57	35	22		Boston, Mass.	58	42	16
Savannah, Ga.	53	47	6		Baltimore, Md.	57	46	11
Eastport, Me.	44	35	9		Portland, Me.	54	37	17
Portland, Oreg.	44	38	6		Wilmington, N. C.	47	51	-4
					Rochester, N. Y.	44	56	-12
					Des Moines, Iowa.	44	54	-10
					New Haven, Conn.	46	46	0

NOTES BY THE EDITOR.

STUDIES ON HURRICANE WINDS AND HIGH WATERS.

The phenomena attending the high water at Charleston, S. C., during the hurricane of September 26, are presented graphically on Chart VI of this REVIEW, as prepared by Gen. E. P. Alexander, of South Island. It will be seen that the records of the self-registering tide gauge show that on the morning of the 25th, and at the close of the 27th, when the winds did not exceed 25 miles per hour, the normal tide and the actual stage of the water agreed closely, but that on the 25th, at noon, when the northeast winds were 24 miles, the water began to rise above its normal height, reaching a maximum at 6.30 p. m. of the 26th, when it was 4.7 feet above the normal, after which it diminished until, on the 27th, at 7 p. m., when the wind was west or northwest, 20 miles, the water had again returned to its normal condition. If we make

allowance for the normal tide it will be found that, owing to the retardation in the movement of the water, the excess of the actual above the normal was a minimum, viz, 1.4 feet from 1 to 3 p. m. of the 26th, after which it increased to 2.0 feet at 5 p. m.; 5.0 at 7 p. m.; 5.1 at 8 p. m.; 4.9 at 9 p. m.; 4.7 at 10 p. m.; 5.0 at 11 and 12 p. m., at which time the central lowest pressure passed over Charleston, and the east wind diminished rapidly before shifting to southwest.

DISTANT STORMS INDICATED BY TIDES AT NEW YORK.

Capt. Edmund Jones who, for many years, kept logs of deep water voyages for Lieut. Maury, and who now lives at Cold Spring Harbor, Suffolk Co., N. Y., states that in connection with a cyclonic storm experienced by the steamship *Italia*, on September 8, in N. 42° 30', W. 41° 05', he made the following observations:

On September 4, I was on the flats at Cold Spring Harbor and noticed that at low water the tide did not fall near as low as it had for several previous days. On September 5, the low tide was at least two feet higher than it should be under ordinary conditions, and I at once came to the conclusion that a cyclone was approaching, as I had noticed before that under these conditions such storms are very certain to make their appearance. On September 6, 7, 8, 9, 10, and 11, there were from three to two feet more water than usual, but during the next two or three days the tide assumed its normal condition. Often during the past fifteen years I have noticed that this abnormal condition is an infallible indication of a storm approaching or passing by. A storm directly in from seaward generally affects the flood tide even more than a low water tide, but in the present case the high water was about normal. A long experience gives me great confidence in the barometer as affording valuable prognostication of a storm, but this tidal wave along the coast preceding a cyclone must, as it seems to me, give absolute proof that some kind of storm is in progress; the astonishing thing is that the ocean level is affected by the cyclone at such a great distance, and especially ahead of it. A careful record of the tide would be of great value during six months of the year.

NORMAL ANNUAL SNOWFALL.

The normal annual snowfall, as resulting from ten years of observations at regular stations, will be given in tabular form in the Report of the Chief of the Weather Bureau. These numbers are reproduced graphically, as far as practicable, on the accompanying Chart V. Each figure may be considered as representing the normal total snowfall in inches from July 1 to the succeeding June 30. The variation of any one year from these figures is an important element in the irregularities of climate and, therefore, the corresponding data for the past year, viz, from July 1, 1893, to June 30, 1894, are also shown upon this map immediately below the normal figures.

The study of the distribution of snow and its apparent dependence upon the intrusion of cold dry air into a region of moist warm air must precede any attempt to specify the meteorological and topographical conditions that prevailed during the so-called glacial epoch of geology. During that epoch snow accumulated to great depths (as now in Greenland), but this accumulation must have been due to the preservation of the snow after it had fallen rather than to any remarkably heavy snowfall. Such glaciation was prob-

ably brought about entirely by gradual and great orographic changes in the continents with the consequent changes in the distribution of the oceans, both of which conspire to greatly change the climate.

OBSERVATIONS AT HONOLULU, HAWAIIAN ISLANDS.

As the weather on the Pacific coast depends so largely upon the conditions of the atmosphere to the westward, it is considered important to publish in full and as soon as practicable the data furnished by observers in Alaska, the Hawaiian Islands, and adjacent regions.

Meteorological observations at Honolulu, Republic of Hawaii, July 18 to 31, inclusive, 1894, by Curtis J. Lyons, Meteorologist to the Government Survey.

Date.	Barometer at sea level.			Temperature.				Humidity.			Wind.		Cirrus cloud moving from—	Rain measured at 6 a. m.
	9 a. m.	3 p. m.	9 p. m.	6 a. m.	2 p. m.	9 p. m.	Minimum.	Maximum.	Relative.	Absolute.	Direction.	Force.		
	Inch.	Inch.	Inch.	°	°	°	°	°	9 a. m.	9 p. m.				Inch.
18..	30.12	30.06	30.14	73	81	75	73	83	55	70	6.4	ne.	5	0.04
19..	30.16	30.08	30.15	74	79	75	73	83	66	6.6	ne.	4-1	.....	0.00
20..	30.12	30.08	30.14	72	79	75	71	81	73	6.5	nne.	5	.....	0.00
21..	30.13	30.06	30.12	74	79	74	72	81	67	75	6.3	ne.	4	0.03
22..	30.10	29.97	30.11	72	77	74	68	79	74	72	6.9	ene.	2-4	0.10
23..	30.08	30.04	30.10	74	81	75	71	84	66	6.4	ne.	5	.....	0.03
24..	30.14	30.09	30.11	72	79	74	68	81	65	6.3	ne.	4	.....	0.10
25..	30.15	30.11	30.15	73	80	75	71	83	57	6.1	ne.	4	.....	0.00
26..	30.16	30.09	30.14	73	81	75	70	83	62	6.4	ne.	4	.....	0.04
27..	30.13	30.06	30.09	72	81	76	71	83	65	6.7	nne.	4	.....	0.02
28..	30.10	30.05	30.12	73	81	75	71	83	64	72	6.8	ne.	3	0.02
29..	30.12	30.07	30.12	72	80	76	71	83	62	6.6	ne.	3	.....	0.05
30..	30.11	30.04	30.10	71	83	75	68	84	62	6.5	ne.	3	.....	0.06
31..	30.09	30.03	30.08	68	81	74	65	85	67	72	6.4	ne.	3	0.01
	30.133	30.076	30.128	73.2	79.7	74.3	70.7	82.3	64.5	70.0	6.5			1.14

Pressure, 30.104, or 0.05 above normal.

Temperature, 75.7°, or 2° below normal.

Rainfall, one-half of the normal.

Relative humidity, 4 per cent lower than normal.

Disturbance periods, as per general rain and surf records, 4th, 12th, 20th, and 28th.

The barometer is corrected for temperature and reduced to sea level, but the gravity correction, -0.06, is still to be applied.

The absolute humidity is expressed in grains of water, per cubic foot, and is the average of four observations daily.

The rain is measured at 6 a. m., daily.

The extremes of the force of the wind are given when it has varied more than usual.

METEOROLOGICAL TABLES.

[Prepared by the Division of Records and Meteorological Data.]

The following pages present in tabular form the climatological data for the current month, on which the text of the preceding part of this REVIEW has, to a large extent, been based.

For a detailed description of the methods of observation, compilation, and computation relating to these tables, the reader is referred to page 129 of the MONTHLY WEATHER REVIEW for March, 1894. The general contents of the tables are as follows:

Table I gives for 140 Weather Bureau stations, making two observations daily, and for 10 others making only one observation, the ordinary climatological data.

Table II gives for about 2,200 stations, occupied by voluntary observers, the mean and extreme temperatures and the total precipitation.

Table III gives climatological data for about 30 Canadian stations.

Table IV *a* gives for 39 Weather Bureau stations the percentages of sunshine for each hour of local mean time.

Table IV *b* gives for 43 Weather Bureau stations the total hourly rainfall for each hour of seventy-fifth meridian time.

Table V gives for 81 stations the mean temperatures for each hour of seventy-fifth meridian time.

Table VI gives for 66 stations the mean pressures for each hour of seventy-fifth meridian time.

Table VII gives for 138 stations the mean hourly movement of the wind.

Table VIII gives for 68 stations the resultant movements and directions of the wind from continuous registrations.

Table IX gives for 140 stations the component and resultant directions of the wind based on simultaneous observations at 8 a. m. and 8 p. m., seventy-fifth meridian time.

Table X *a* gives for 47 voluntary stations the normals and current departures of mean monthly temperatures.

Table X *b* gives for the same stations the similar data as to precipitation.

Table XI gives for each day of the month the number of thunderstorms (T), and of auroras (A), reported by all the observers of each State.

Table XII gives the principal climatic features of the month as reported by each State weather service.